

**REMARKS/ARGUMENTS**

This Amendment is responsive to the Office Action mailed on August 22, 2008.

In this Amendment, claim 43, 59, and 62 are amended, claim 66 is added, and no claims are canceled, so that claims 40-50 and 52-66 are pending and subject to examination.

In the Office Action, claims 40-50, and 52-65 are rejected as being unpatentable over Alivisatos '198 and Bewendi '901 under 35 U.S.C. 103(a). The Examiner admits that Alivisatos '198 fails to teach or suggest nanoparticles coated with at least two monolayers. However, the Examiner alleges that Bewendi '901 "states that materials used for cores and monolayers may be varied. See abstract, column 7, lines 30-67, [and] column 8, lines 11-59." This rejection is traversed.

**I. Obviousness has not been established, because all limitations in the independent claims are not taught or suggested by the cited art**

**A. Independent claim 40 and claims dependent thereon**

Obviousness has not been established with respect to independent claim 40 (and claims dependent thereon), since all limitations are not taught or suggested by the cited art. For example, with respect to claim 1, neither Alivisatos '198 nor Bewendi '901 teaches or suggests "a graded shell overlying the core, wherein the graded shell comprises at least two monolayers" as recited in independent claim 40. As explained at paragraph [0043] of the present application, in some embodiments of the invention, a graded shell can include a pure monolayer of CdS with a subsequently gradual change to ZnS. The Examiner alleges that the abstract, column 7, lines 30-67, [and] column 8, lines 11-59 of Bewendi et al. teach that "materials for cores and monolayers may be varied."

Contrary to the Examiner's allegation, these passages describe *pure* ZnS shells on cores of CdSe, and they do not teach that materials within a shell can be varied. For example, column 7, lines 30-67 of Bewendi et al., which is relied upon by the Examiner, is reproduced below.

The synthesis described above produces overcoated quantum dots with a range of core and shell sizes. Significantly, the method of the invention allows both the size distribution of the nanocrystallites and the thickness of the overcoating to be independently controlled. FIG. 1 shows the absorption spectra of CdSe dots with a particle size distribution of (a) 23 Å, (b) 42 Å, (c) 48 Å and (d) 55 Å in diameter before (dashed lines) and after (solid lines) overcoating with 1-2 monolayers of ZnS. By "monolayer" as that term is used herein, it is meant a shell of ZnS which measures 3.1 Å (the distance between consecutive planes along the [002] axis in the bulk wurtzite ZnS) along the major axis of the prolate shaped dots. The absorption spectra represents the wavelength and intensity of absorption of light which is absorbed by the quantum dot. FIG. 1 indicates a small shift in the absorption spectra to the red (lower energies) after overcoating due to the partial leakage of the exciton into the ZnS matrix. This red shift is more pronounced in smaller dots where the leakage of the exciton into the ZnS shell has a more dramatic effect on the confinement energies of the charge carriers.

FIG. 2 shows the room temperature photoluminescence spectra (PL) of the samples shown in FIG. 1 before (dashed lines) and after (solid lines) overcoating with ZnS. The PL quantum yield increases from 5-15% for bare dots to values ranging from 30% to 50% for dots passivated with ZnS. The PL spectra are much more intense due to their higher quantum yield of (a) 40%, (b) 50%, (c) 35% and (d) 30%, respectively. The quantum yield reaches a maximum value with the addition of approximately 1.5 monolayers of ZnS. A decrease in quantum yields at higher ZnS coverages may be due to the formation of defects in the ZnS shell.

FIG. 3 is a color photograph which demonstrates the wide spectral range of luminescence from the (CdSe)ZnS composite quantum dots of the present invention. The photograph shows six different samples of ZnS overcoated CdSe dots dispersed in dilute hexane solutions and placed in

As noted above, at column 7, line 40, the "monolayer" in Bewendi et al. is made of "a shell of ZnS." There is no suggestion in Bewendi et al. of even forming CdS and ZnS in a shell, let alone forming a "graded shell overlying [a] core" in a "nanorod." Consequently, obviousness has not been established.

B. Independent claim 53 and claims dependent thereon

Independent claim 53 (and claims dependent thereon) is also not obvious in view of Alivisatos '198 and/or Bewendi '901. Independent claim 53 recites, *inter alia*, "a first segment of a first material; and a second segment of a second material joined longitudinally to said first segment." This structure is not described in Alivisatos '198 or Bewendi '901. In fact, the rejection fails to even address this limitation and fails to provide any citation from Alivisatos et al. or Bewendi et al. which might teach or suggest this feature. Since the Office Action fails to indicate where "a first segment of a first material; and a second segment of a second material

joined longitudinally to said first segment” is taught or suggested by the cited art, obviousness has clearly not been established with respect to independent claim 53 or any claims dependent thereon.

**II. Obviousness has not been established with respect to many dependent claims, because many of the limitations in the dependent claims are not even addressed in the Office Action.**

Obviousness has not been established with respect to many dependent claims, because many of the limitations in the dependent claims are not even addressed in the Office Action. For example, dependent claim 56 mentions different longitudinal segments having different cross sectional areas. The Examiner fails to address this limitation, and other limitations in the dependent claims. Consequently, the dependent claims are clearly patentable in view of the cited art.

Should the Examiner maintain the rejection of the dependent claims, the Examiner is respectfully requested to cite passages from the prior art to support the rejection.

**Conclusion**

In view of the above arguments, it is believed that the pending claims are in condition for allowance. A Notice of Allowance is respectfully and earnestly solicited.

Respectfully submitted,  
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